

LV.—On the Willemoesia Group of Crustacea.

By C. SPENCE BATE, F.R.S.

My paper on these Crustacea in the October number of the 'Annals' was never intended to be exhaustive of the subject; but I certainly think that it was sufficiently clear to have precluded questions and criticisms that without difficulty might have been settled by one who has the advantage of being in possession of specimens of the group.

The Rev. A. M. Norman says ('Annals,' November, p. 382), "I do not see my way at present to acquiescing in his conclusions, and therefore venture to ask him to give us further information."

His first question is, "Are his genera *Pentacheles* and *Willemoesia* any thing more than the other sex of *Polycheles*?"

Having just given a paper to prove that they are distinct and not one and the same species, I beg to repeat that *Pentacheles* and *Willemoesia* are not the other sex of *Polycheles*, and to refer him to my paper for details.

The next question is, "Has not my friend mistaken *sexual* for *generic* characters?" to which I reply, most certainly not. Then he asks, "Has he male and female of any *Polycheles* or any *Pentacheles*?" in reply to which I wish to add the following list:—

<i>Willemoesia leptodactyla</i> ,	male and female.
<i>Pentacheles lævis</i> . . .	female.
— <i>Suhmi</i>	male.
— <i>obscurus</i>	female.
— <i>auriculatus</i> . . .	female.
— <i>gracilis</i>	female.
— <i>enthrix</i>	female.
<i>Polycheles baccatus</i> .	male and female.
— <i>Helleri</i>	male and female.
— <i>crucifer</i>	male.

It will thus be seen that I have males and females of each genus.

I would, however, add that for some time I was hesitating where several species of *Pentacheles* should be placed, as there is a regular gradation from the imperfect to the perfect chelate character of the fifth pereopod; but as I found *Polycheles*, both male and female, with the simple non-chelate foot, at present it appears to me that there is no arrangement so constant as that which I propose.

The next question the Rev. A. M. Norman asks is, "If so, will he let us know how these sexes are distinguished?"

When I read this I began to think that my reverend friend was poking fun at me. Does he really mean to insinuate that he thought I was not acquainted with what every fish-wife knows—the features distinctive between a male and female crustacean? Reading a little further, I find that the Rev. A. M. Norman had before him two specimens dredged during the ‘Porcupine’ expedition in 1870 (eight years ago), off the Spanish coast, which, he says, he considers to be “male and female of *Polycheles typhlops*, Heller; but the one is, according to Bate, a member of another genus (*Pentacheles*) differing from *Polycheles* in having the last pereopods chelate, a deeper notch on each side of the front of the carapace, and slight diversity in the lateral and dorsal spiny adornments of the carapace. These are the only two specimens I have seen; my conclusion that their difference is sexual *may* be wrong. Can Mr. Bate *prove* it to be so?”* I have little doubt that I can and will, if he will intrust me with the specimens.

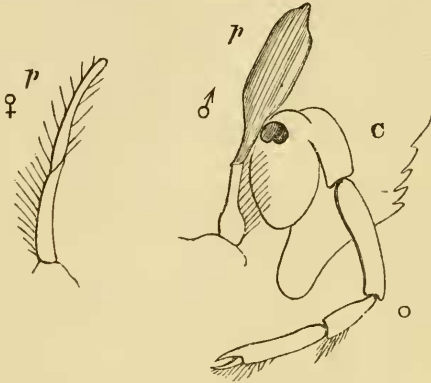
But why has not the Rev. A. M. Norman determined for himself their sexual relation to each other (he has, it appears, already had them eight years in his possession)? or is he really in earnest when he says, “Will he let us know how these sexes are distinguished?” Is this the reason why the Rev. A. M. Norman only *considers* them male and female, and yet criticizes the classification of others, while, in a note, he takes credit for having paired the British *Hyperie* and *Lestrigoni*? May I ask if he has done this also without observation of the sexual features? If so, all his arrangements can only be a more or less successful set of guesses.

As the *Willemoesia* group consists of animals that have not generally been met with, I would merely remark (and this may be of some assistance to the Rev. A. M. Norman in determining the relation that his two specimens bear to one another) that the organs of generation are generally very conspicuous, and situated as they universally are in macrurous Crustacea; but there is one feature that accompanies each sex that may be depended upon and be of material assistance in broken or injured specimens.

The first pair of pleopoda in the female has a tolerably long basal joint, with the terminal branch single and reduced to a feeble condition; while in the male the basal joint is short, and the terminal one long, stiff, and, shaped somewhat like a marrow-spoon, it lies with the concave surface next the pereion, and is evidently adapted, and I have no doubt is used, for the purpose of supporting the membranous penis during

* The italics are the Rev. A. M. Norman's.

the period of coition, and that it assists by compressing the male organ against the vulva of the female. I am inclined to think, from the variation of this organ in other families, that there may be a tendency to vary in size the nearer or the more distant may be the rutting-season. It varies somewhat in form with the species.



Willemoesia leptodactyla. C, posterior extremity of carapace; o, fifth pereiopod, with the orifice of the male organ in the basal joint; p, first pleopod.

The second set of questions that the Rev. A. M. Norman proposes relate to the eyes. "Eyes," he says, "are things to see with." True; but he must admit that they are not always available for this purpose. Then the Rev. A. M. Norman says, "Has *Polycheles* such organs?" Most decidedly it has; and I gave a distinct figure of one in the October number of the 'Annals.' But why did not the Rev. A. M. Norman examine the specimens in his possession? he would not then have had to write, "it were to be wished that Mr. Bate had lettered the figures of the plate to have made them more clear." Had I thought there would have been any difficulty in understanding them I would; but I felt that I was writing for advanced carcinologists, and therefore thought that the references would be unnecessary*.

Most certainly the eye I described is not on "the base of the peduncle of the inner antennæ," which, from its situation, cannot be the homologue of the true eye. That which I describe as being the eye is homologically the same as that found in *Astacus*, *Cancer*, &c.

* I see that, in the plate alluded to, fig. 1^o has no reference; it is the fifth pereiopod of *Pentacheles gracilis*.

There was no "round black spot" on the base of the peduncle of the inner antennæ in any of the specimens that came within my observation; but there is a depression that may correspond with it, and is probably that which Heller noticed, but it is caused by the olfactory tubercle of the second or outer antennæ being impacted strongly against the inner. In the basal joint of the inner antennæ I have dissected out an osseous auditory apparatus, which is sufficient itself to determine that this same position cannot be occupied by an organ of sight.

The third set of questions evidently shows that my paper was read for the sake of criticism. I never said or thought that *Polycheles* was related in any way to *Alpheus*. I merely paralleled the development of the eyes in the two genera and the probable similitude of adult existence; and the Rev. A. M. Norman further adds, with a note of admiration to give it the more weight, "that the embryos of both have 'large and distinctly pedunculated eyes,' a character which, I take it, is not very rare among the embryos of the Macrurous Crustacea!" My remarks were in relation to adult forms with "depauperized organs of vision;" and therefore the Rev. A. M. Norman's remarks do not bear on the subject unless he knows the embryonic form of *Astacus? zaleucus* (Willemoes-Suhm), *Nephropsis Stewarti* (Wood-Mason), and the blind prawns of the North-American caverns.

With regard to the fourth set of questions, which relate to *Eryon*, I offer no opinion, but hope to be able, at no very distant date, to avail myself of the best opportunities at my command; in the meantime I cannot help remarking that all the notes on which the Rev. A. M. Norman lays so much stress are but negative in character.

However, I am much obliged for having my attention directed to points which I hope will enable the Rev. A. M. Norman to determine the sexual character of his own specimens of this group; and I can only add that I should have done it with more pleasure had the Rev. A. M. Norman's paper been written less in the style of a categorical examination.

LESTRIGONUS.

With regard to the notes relating to *Lestrigonus* the rev. gentleman has gone out of his way, and shows the character of his criticisms. He says, "There is another case, however, in which Mr. Bate persists against proof in maintaining a genus founded on mere sexual characters; but all other carcinologists are, I believe, agreed that *Lestrigonus* is simply the male of *Hyperia*; and I have myself paired the British species."

If the Rev. A. M. Norman will turn to the 'Catalogue of Amphipoda' as far back as 1862, as well as to the 'History of the British Sessile-eyed Crustacea,' he will find that the relationship of *Lestrignonus* to *Hyperia* is distinctly mentioned; and in the latter appears the following passage:—

"In the same work ('Catalogue of Amphipoda') Mr. S. Bate has also suggested that the species of the present genus are but females of those of *Lestrignonus*. He arrived at this conclusion after examining a considerable number of species of both genera, finding it difficult, if not impossible, to assert (with reference to the structure of the antennæ) where one genus commences and the other ends. Recently, through the kindness of Mr. Edward, of Banff, we have had the opportunity of examining many fresh specimens both of *Lestrignonus* and *Hyperia* from the same locality; and we found that all the adult *Hyperia* of which the sex could be detected were females, but that none of the *Lestrigoni* were of that sex."

I feel somewhat ashamed to quote so long a passage out of that work for the purpose of replying to such small criticism, and to show that the Rev. A. M. Norman had no right to say that I "persist against proof," when he must have known that he himself took the inspiration of which he boasts from the writings of others, even if he has himself "paired the British species described by Bate and Westwood." See Brit.-Assoc. Report, 1868, p. 286, for the way he has done this.

"*Hyperia galba* (Montagu), Bate & Westw. Brit. Sessile-eyed Crust. vol. ii. p. 12, the female, = *Lestrignonus Kinahani*, Bate & Westw. l. c. p. 8, the male, =? *Lestrignonus exulans*, l. c. p. 5, the young male, =? *Hyperia medusarum*, Bate, Cat. Amph. Crust. Brit. Mus. p. 295, pl. xlix. fig. 1, the young female (but not *Metæcus medusarum*, Kröyer). In *Aurelia*, open sea, twenty-five miles N. by W. of Unst.

"I believe that the above four so-called species are the different sexes and periods of growth of one. The specific points will be found in the structure of the gnathopods (as accurately described by Bate & Westw. under *Lestrignonus exulans*) and of the uropods, which have the rami of all three pairs wide in the middle, but narrowed at the base and mucronate at the terminations; the inner margins of the rami of the first pair, and the inner margin of the outer ramus, and both margins of the inner ramus of the last two pairs are elegantly serrated."

To *Lestrignonus exulans* and *Hyperia medusarum* he prefixes a ?, to show that he felt doubtful of his facts; and in writing he says, "I believe that the above four so-called species are the different sexes and periods of growth of one." I therefore

maintain that, whether they be all of one species or not, the Rev. A. M. Norman has done nothing to prove they are or are not *sexually* distinct. It is, however, too small a subject to pursue further. I feel assured, as was stated in the 'History of the British Sessile-eyed Crustacea,' that the *Lestrigoni* are the males of *Hyperia*; but I also think that it is desirable not to sink the name of the male until a new work of reference takes the place of those at present in use, wherein it is known as *Lestrigonus**.

The specimen from which I described *Diastylis bimarginatus* was a very poor one, and much broken before it reached me; but certainly it is not *Diastylis spinosa* of Norman, or his name and description are singularly infelicitous.

BIBLIOGRAPHICAL NOTICES.

The Geology of Sussex; or the Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex. By the late FREDERICK DIXON, Esq., F.G.S. New Edition. Revised and augmented by Professor T. RUPERT JONES, F.R.S., F.G.S. 4to. Pp. xxiv and 469. With a Geological Map, 64 plates, and numerous woodcuts. W. J. Smith: Brighton, 1878.

THE first edition of this splendid work, so well known to geologists, was published in 1850, when Mr. Dixon's posthumous writings were completed and supplemented by his friends Professors Owen, Bell, and Forbes, Messrs. Sowerby, Lonsdale, and others, and edited by Owen himself. The illustrations and descriptions of the Tertiary and Cretaceous fossils then supplied to geologists rendered this a classic English work. Since Mr. Dixon's decease further researches among the highly fossiliferous strata of Bracklesham and the neighbouring districts have enabled Prestwich, Edwards, Fisher, and others to compare and classify this portion of the Eocene formations, with great exactitude, one with another and with similar strata in France and elsewhere. So also with regard to more recent deposits along the Sussex sea-board, R. Godwin-Austen, J. Prestwich, and A. Bell have elucidated, far more clearly than previously, the extent, relations, and age of the "old raised beach," the "boulder-bed," the "mud-deposit," and other now well-known Post-tertiary formations, which had already received much attention from Mantell, Lyell, Dixon, and earlier observers.

* When I wrote to the 'Annals' I was under the impression that *Lestrigonus* had priority of date to *Hyperia*; but I find that the latter is one year in advance. Hence I wrote as I did, rather than *Hyperia* (*Lestrigonus*) *spinidorsalis*. I thank the Rev. A. M. Norman for giving me the opportunity of correcting it.